D. Drawings

Please enter the two attached replacement sheets, one each for Fig. 8 and Fig. 20.

E. Remarks

The claims are 1-10 and 12-33, with claims 1 and 13-17 being independent. Claim 11 has been cancelled without prejudice or disclaimer. Claims 1-10 and 12-32 have been generally amended to clarify the invention and to correct minor informalities. In addition, each of the independent claims has been amended to include halftoning. New claim 33 has been added. Applicants submit that each of the claim amendments and the new claim are fully supported by the application as filed and that, therefore, no new matter has been added. Reconsideration of the present claims is respectfully requested.

The specification has been amended in two locations, the first to correct minor typographical errors and the second to more accurately portray step 1812. Applicants submit that each of the changes is fully supported by the application as filed and that, therefore, no new matter has been added.

Applicants have revised each of Figs. 8 and 20 and include herewith appropriate replacement sheets. Fig. 8 has been revised to more accurately portray step 1812, and Fig. 20 has been revised by removing the arrow extending downward from box 2008. Applicants submit that each of the changes is fully supported by the application as filed and that, therefore, no new matter has been added.

The Examiner objected to claim 1 due to its use of the word "term". Applicants have now amended the claims to more clearly set forth the present invention.

The Examiner also objected to claims 30-32 under 37 C.F.R. 1.75(c) as being in improper multiple dependent form. Applicants have now amended the claims to

remove the improper multiple dependency therefrom.

Claim 13 stands rejected under 35 U.S.C. §102(b) as being anticipated by Hines (U.S. Patent No. 6,034,782). Applicants respectfully traverse this rejection.

Hines is concerned with using a printer I/O channel in a manner that maintains both print speed and print quality (col. 1, lines 7-9). Hines thus proposes the use of a test application to determine whether the PC that is to print material over a communications connection is able to maintain at least a predetermined speed of data transfer. If this speed is not adequate, then subsequent data is preferably compressed before transmission (col. 2, lines 6-9 and 23-28). Hines makes reference to error diffusion data; however, this is merely one example of data which is useful for Hines in describing the invention. Hines states that "although other types of data might also be appropriate, error diffusion table data has the desirable property of being sufficiently voluminous and random to serve as an effective test of the printer's ability to receive and format a large volume of data" (col. 3, lines 54-58).

Simply put, Hines does not disclose or suggest several features of the presently amended claim 13. First, Hines does not disclose or suggest tuning an error diffusion table to establish a relationship between image values and corresponding average nozzle firing values dependent upon printing desirability factors of the print nozzles in the print head. Likewise, Hines does not disclose or suggest biasing, for each image value associated with a defective nozzle, at least one second image value associated with another nozzle, said biasing being dependent upon said first image value and a printing desirability factor for the defective nozzle. Accordingly, Hines does not anticipate (or render obvious)

the present invention as set forth in claim 13, and Applicants respectfully request withdrawal of the §102 rejection premised upon it.

Claims 1-5 stand rejected under 35 U.S.C. §103(a) as being obvious over Hickman (U.S. Patent No. 4,963,882). Claims 6-9 stand rejected under 35 U.S.C. §103(a) as being obvious over Hickman in view of Suzuki (U.S. Patent No. 6,036,300). Claim 10 stands rejected under 35 U.S.C. §103(a) as being obvious over Hickman in view of Suzuki and further in view of Semasa (U.S. Patent No. 5,418,626). Claims 11 and 12 stand rejected under 35 U.S.C. §103(a) as being obvious over Hickman in view of Suzuki and further in view of Yen (U.S. Patent No. 5,992,962). Claims 14-27 stand rejected under 35 U.S.C. §103(a) as being obvious over Suzuki. Claim 29 stands rejected under 35 U.S.C. §103(a) as being obvious over Suzuki in view of Semasa, Yen and Hines. Applicants respectfully traverse these rejections.

First turning to Hickman, Hickman uses multiple nozzles per pixel location (see abstract). More particularly, Hickman forms each dot (of a printed image) with at least two droplets of ink of the same color, each droplet being ejected from a different nozzle (col. 3, lines 36-39). Fig. 8 in Hickman shows how two dots are deposited on each pixel location, each droplet being ejected from a different nozzle (col. 8, lines 50-53). If a nozzle becomes partially or wholly inoperative (col. 8, lines 66-67), then as shown in Fig. 9, one set of dots is still present even if one of the two nozzles fails (col. 9, lines 1-3). According to this approach, image degradation is small (col. 9, lines 8-9).

The approach described in Hickman is, as shown above, based upon the fact that since the printing at each pixel position is performed by printing the image value

at each pixel position twice, using two separate nozzles, then if one of the nozzles is defective, at least half of the desired image value will be printed at the pixel position, thus reducing the effect of the defective nozzle. The output printed by each set of nozzles in Hickman is, therefore, performed in a blind manner, wherein as shown in regard to Figs. 8 and 9, if one nozzle is defective, one is merely left with the output of the other nozzle which traverses the same pixel position. The "healthy" nozzle in Hickman is unaware of the other nozzle which is defective, and the image value printed by that nozzle is not affected in any way by the fact that the other nozzle is defective.

In contrast, defective nozzle compensation is accomplished in the present invention using an entirely different approach from that of Hickman. More particularly, according to each of the present claims, an image value, i.e., the value of the image that is to be printed by a particular nozzle, is biased; the biasing is dependent upon a first image value and a printing desirability factor for a first nozzle. (The printing effectiveness factor allows for the defective nozzle to be either fully defective i.e., completely blocked, or partially defective, i.e. capable of printing something but not the desired image value; the ability to take into account the printing effectiveness factor is a significant advantage in addressing partially defective nozzles (in order to ensure that the claimed image redistribution method provides a consistent result)(p. 24, lines 24-38)). This means that the image value that is to be printed by a particular nozzle, as well as a printing effectiveness factor for that nozzle, is taken into account by biasing an image value associated with another nozzle. The other nozzle thus prints an image value different from that which it would have printed in the absence of a defective nozzle, in order to emulate the intended

output of the defective nozzle.

In addition to the difference in approach, the present claims require halftoning at least one biased second image value to form at least one corresponding nozzle firing value and printing the image using the at least one nozzle firing value. Hickman does not disclose or suggest these features.

Accordingly, it is clear that Hickman fails to disclose or suggest several key features of the presently claimed invention. In order to modify Hickman in such a manner as to arrive at the present invention, it would be necessary for Hickman to bias, i.e., vary, the image value associated with a particular nozzle in order to compensate for the fact that another nozzle is defective. Furthermore, it would be necessary for this biasing to be dependent both upon the image value associated with the defective nozzle and also to be associated with a printing desirability factor for that first nozzle. What is more, Hickman would have to be modified to incorporate halftoning and printing using at least one nozzle firing value.

Turning next to Suzuki, it would be helpful to address certain terminology issues. In Suzuki, an image processing unit receives the "original image data" from an image reading device. This image processing unit processes the "original image data" and outputs "image data" (also referred to as "recording data" or "recorded image data"; col. 18, lines 14 and 20) to be used by an "image recording unit" for "recording" onto recording media (Fig. 8 and col. 5, lines 39-47). The term "recording unit" appears to be a generic term encompassing, for example, specific terms such as the "ink jet recording unit" A-2 in Fig. 9 (col. 5, line 52). The ink jet recording unit A-2 includes a "printing

unit" 31 (col. 7, line 33). The term "recording data" can be understood from the statement that "it is assumed . . . that the density of the recorded dots read by the CCD sensor 404 is given as D_0, and the recording density estimated from the recording data corresponding to such density is given as D_i" (col. 18, lines 18-22). The "recorded dots" refer to the dots physically printed on the print medium and whose density is measured using the CCD sensor. Consequently, the "recording data" are the signals provided to the recording unit in order to output the aforementioned recorded dots. In regard to Fig. 23 of Suzuki "A reference numeral 440 designates a division unit to calculate the ratio D_0/D_i between the actually recorded density (presumably of the recorded dots) and the density of the image data; and 441 and 442, γ control units, respectively, to modify the image data to be output to the . . . recording head" (col. 18, lines 38-44).

Accordingly, the following table presents concordance between terminology in Suzuki and the present application:

Suzuki	present application
original image data	image value
DOES NOT DISCLOSE	biased image value
image data (or recorded image data or recorded data)	nozzle firing value
modified image data (produced by gamma control units)	DOES NOT DISCLOSE
recording unit or printing unit	printer nozzle

So, according to the present invention, if a nozzle is defective and biasing is needed, the image value "is distributed to the other nozzle, i.e., the input image signal for the current nozzle is added to the input image signal for the other nozzle" (p. 11, lines 17-

19). Thereafter, the nozzle firing data is generated using a halftoning process (see Fig. 4 and the description at p. 9, lines 3-13). In other words, image values are biased to form biased image values which are then halftoned to form corresponding nozzle firing values which drive the print nozzles to print an image.

By contrast, Suzuki does not modify image values (equivalent to original image data in Suzuki) as in the present invention. Instead, Suzuki modifies its image data which is equivalent to the present nozzle firing values (after halftoning). What is more, Suzuki's modification consists of the use of gamma correction units and not a biasing operation as in the present invention. Suzuki does not even touch upon halftoning. For all of these reasons, it is clear that Suzuki fails to disclose or suggest the present invention.

Hines is deficient for the reasons set forth above with regard to the §102 rejection. Specifically, Hines fails to disclose or suggest biasing, for each image value associated with a defective nozzle, at least one second image value associated with another nozzle, said biasing being dependent upon said first image value and a printing desirability factor for the defective nozzle.

Semasa and Yen do not remedy the deficiencies of Hickman, Suzuki and Hines. Semasa is concerned with the provision of an image processing device for resolution conversion in a manner in which the gradation of the original image is preserved, and the moires are not developed such that a converted image of good quality is obtained (col. 1, lines 64-68). Yen is concerned with an improved masking technique for reducing or eliminating banding artefacts and ink migration in output produced by inkjet printers (col. 1, lines 6-10). Yen "applies various print mask patterns . . . which . . . reduce

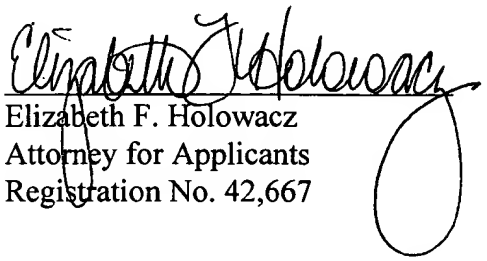
or substantially eliminate the banding phenomenon" (col. 3, lines 35-43). Yen notes that print masks are used to control the firing sequence of the nozzles in a print head in multiple pass printing mode and thereby determine the nozzles that are to print in each particular media location (see abstract). Semasa and Yen suffer from many of the same deficiencies as Suzuki.

In conclusion, none of the cited references (whether considered alone or in any combination) render the present invention obvious. There is simply no disclosure or suggestion of certain key features of the presently claimed invention, namely (the method of or means to accomplish) biasing image values to form biased image values, halftoning the biased image values to generate nozzle firing values and then printing based on those nozzle firing values. Accordingly, withdrawal of the §103 rejections is respectfully requested.

In view of the foregoing amendments and remarks, favorable reconsideration and passage to issue of the present case is respectfully requested. If, upon consideration of this paper, the Examiner believes there are any outstanding issues, it is respectfully requested that the Examiner contact the undersigned attorney in an effort to expeditiously resolve such issues.

Applicants' undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,



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